

ERIC Document Resume		See Instruction Sheet		DATE OF RESUME 10/28/65		DATE RECEIVED	
A. PUBLICATION DATA							
1. ERIC NUMBER ED002222		2. ORIGINATOR CONTROL NO(S). N.A.		3. IDENTIFICATION NO. 1522		DO NOT WRITE IN SPACE BELOW	
4. AUTHOR(S): Hoban, Charles F., Jr.						MICROFILM COPY AVAILABLE YES ☒ NO ☐	
5. TITLE OF DOCUMENT ABSTRACTED: The Setting of the Problem						COPYRIGHT GRANTED YES ☐ NO ☒	
6. PUBLICATION TITLE: Research in New Media in Education						COPYRIGHT RELEASE FILED YES ☐ NO ☐	
7. EDITOR(S): N.A.				8. PLACE OF ORIGIN University ORG. of Michigan, ST. Ann Arbor, Michigan CITY, STATE		TYPE OF REPORT PROPOSAL ☐ IN-PROGRESS ☐ FINAL ☒ FOLLOW-UP ☐	
9. PUBLISHER OR SOURCE American Assoc. of Colleges for Teacher Education, Univ. of Michigan, Ann Arbor, Michigan						OTHER ERIC REFERENCES:	
10. VOL. N.A.	11. PAGES N.A.	12. MO./YR. 1/61	13. TOTAL PP. 28	TELE. INST/LOC CODE	EXT.	ERIC SATELLITE CODE	
B. INDEXING DATA							
14. SUBJECT AREA				15. TYPE OF ENDEAVOR Report			
16. INDEXING TERMS (8-12)							
instructional media		media research		technology concepts		systems concepts	
television		teaching machines				instructional innovation	
						instructional technology	
17. ABSTRACT (MAX. 250 WORDS)							
Newer media research attempts to provide information which can deepen, broaden, and extend administrators' and teachers' knowledge of the use of new media. Media research has not been an effective instrument for deepening the capacity of educational policy-makers for sound judgments in this area. Difficulties of policy making are the attribution of great power to the media of communication, and the ignorance or avoidance of the complexity of communication that leads to overoptimism about results to be obtained when new communications media are introduced into education. Lack of adequate knowledge about technological devices hampers judgment in the acceptance, rejection, adaption, or imaginative experimentation in the uses of newer media in education. The major developments evident in newer media involve the concepts of newer media as primary instruments of instruction, and the control of learning by remote control of stimulus and response. Significant concepts of newer media include the following: technology involves an integrated complex of ideas, organization, management, and machines; a system is an arrangement of components so that compatability and purposeful performance are achieved by organization and adjustment between and among the components; and innovation involves the human reception of and response to a new idea carried or about to be carried into action. Instructional efficiency of newer media derives not so much from the media themselves as from the effective use of psychological principles of teaching and learning incorporated into the media.							
ERIC No.	18. SOURCE OF ABSTRACT						
	C. FUNDING DATA						
	19. SUPPORTING ORGANIZATION			20. DIVISION OR DEPT.		21. CONTRACT NO.	
						PROJECT NO.	
				22. TOTAL COST OF PROJECT			
			23. DURATION OR PROJECT		U.S. Department of Health, Education, and Welfare Office of Education		

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INSTRUCTIONAL TECHNOLOGY - U.S.C.
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I: THE SETTING OF THE PROBLEM

Colleges and universities engaged in the education of teachers are confronted with a set of problems unprecedented in the history of teacher education and unequalled in the field of higher education. These problems are inseparable from the social upheaval and cultural crisis of our time. They are manifestations of this upheaval and this crisis, particularized in one specific institution of American society. Standardization of mediocrity, contentment with the status quo, protection of vested interests, social detachment, and disavowal of social realities and responsibilities that marked the national character in the fifties are totally inadequate mechanisms for coping with the survival demands of the sixties — in politics, in industry, or in education.

In essence, this is the broad setting in which this seminar meets to confront the fact of newer media in education, and the problem of what colleges for teacher education can and must do about this fact.

Members of this seminar are well aware of the changes, both substantive and administrative, of the elementary and secondary schools occurring in the curriculum of the elementary and secondary schools. Substantive changes are of at least four kinds:

- (1): Curriculum differentiation for students differing in academic abilities,
- (2): Reorganization of content and method within the traditional disciplines,

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Research in New Media in Education" by Charles F. Hoban, Jr. In
Three Conference Working Papers for The Nat'l Conference on Teacher Education
and New Media Jan. 8-11, 1961. ¹ Univ. of Michigan Ann Arbor, Mich.
Amer. Assn. of Colleges for Teacher Educ.

- (3): Additions to the curriculum at all major levels, and
- (4): Downward thrust of placement of subjects from college to secondary school, and from secondary school to elementary school.

At least two administrative changes appear to be inescapable:

- (1): Re-grouping and re-routing of students through the curriculum, and
- (2): Calendar adjustments in length of both the school day and the school year.

Calendar adjustments are already in effect. At my own University, for example, the trimester plan is scheduled to go into effect in September, 1961. Under this plan, a student may complete the eight semesters usually required for the bachelor's degree in three years. In my own community of Upper Darby Township, students following an accelerated high school curriculum may attend summer sessions for this purpose, while others may explore new interest areas, particularly in science, and still others, with poor foundations in basis subjects, may strengthen these foundations in refresher courses.

Another alternative in coping with the problems of education is the increase in efficiency of teaching by use of newer media of communication. This is the alternative with which we are dealing at this conference.

Much of the research on newer media in education has been oriented in terms of the efficiency of these media, i. e., in terms of the increases in learning obtainable from these media within any constant time period, or in terms of the factors tending to increase or decrease this efficiency.

Experiments in the use of television in education are justified in terms of the ability of this medium to expose a greater quantity of stu-

dents to the talents of "the master teacher", or to reduce the number of teachers required by increasing student enrollments, or to reduce time and effort required in getting to and from college classrooms, or to release teacher time for research or for student counselling, etc., or to bring otherwise unavailable competent teachers and essential demonstrations to rural schools, etc., etc.. Teaching machines, a misnomer we will consider later, are being justified in terms of their insurance of optimum learning conditions, which include self-pacing of individual progress, and a continuing dialogue between student and tutor.

II: RESEARCH AND POLICY-MAKING

We can all make best use of research in education if we understand the purpose of research, particularly in the formulation of policy.

Max F. Millikan puts it this way: "The purpose of social science research should be to deepen, broaden, and extend the policy-maker's capacity for judgment - not to provide him with answers." (1) 'Research on newer media in education is social science research. Its purpose has been, as Millikan suggests, to provide information which will deepen, broaden, and extend the policy-maker's capacity for judgment.

Anyone who looks to media research for answers will be disappointed. Furthermore, he is quite likely to find the results of research disappointing in at least two other respects. For one thing, media research has rarely verified the spectacular results often claimed for these media. In some instances, it has deflated these claims, and thereby increased the unpopu-

larity of the researcher. Furthermore, media research has rarely produced results which were not intuitively known beforehand.

So, in dealing with media research, we will be dealing with a set of conclusions which some policy-makers will claim were already well known without the benefit of tedious and ~~expensive~~ research, and other policy-makers will find uncomfortable because the research might well deny expectations that have proved to be overoptimistic.

III: BLOCKS TO JUDGMENT

It is no gross exaggeration to say that, on the whole, media research has not been an effective instrument for deepening the capacity of educational policy-makers on the state and local levels for sound judgments in this area. The researchers are partly responsible for this, in that they have either not tried to make their findings meaningful to people outside their own ranks, or when they have done so they have often written in their own terms rather than in those reflecting the range of concerns and problems faced by policy-makers.

However, policy-makers create many of their own problems, as well as having them created by others, by subscribing to misconceptions, confusion, and misleading classifications. These add to the difficulty of policy-making and lead to policy errors. Three of these will be discussed.

1. Overexpectation

It is widely held that at least some of the newer media possess great power over mind and overt behavior power which can be used with unprecented

effectiveness for the fulfillment of man's highest potentialities. Somehow, this power seems to reside in the media themselves, rather than in the informational content, the manner of presentation of this content, the viewers' readiness to receive this content, and the relationship of all these to the social milieu.

As a result of the attribution of great power to the media themselves, too much is expected in the way of results from the introduction and use of these media in the educational process. This holds, I believe, for all the newer media, including what we have misnamed as "teaching machines". Certainly, it has held for motion pictures and television in education.

Underlying this overexpectation are two fundamental conceptual errors. The one is that communication is the transmission of meaning among people. The other is that there is a causal rather than an instrumental relationship between information and overt action.

Meanings cannot be transmitted. Meaningful sets of symbols can. For our purpose, we can consider meaningful symbols as information, and we can assume that symbols are meaningful when there is consensus as to what they symbolize, and when the pattern of their presentation is consistent with established conventions. Some of our difficulties with extreme forms of modern art arise from the fact that there is a lack of consensus on what the symbols represent, aggravated by unaccustomed patterns of presentation of these symbols. To pursue this subject further is to get into deeper water than necessary. The essential point is that the transmission of meanings is an idealistic goal of communication, but a psychologically inaccurate description or definition of the process.

When it is understood that information, not the meaning of information, is transmitted in communication, the great complexity of communication is apparent. The complexity of the process is, if anything, increased when newer media are introduced into education.

For example, the highly publicized project in airborne television in the Midwest is now confronted with the discomfoting realization that, once the mechanics of an airborne relay station have been worked out, the much more difficult problems of effective program selection, production, and coordination with the curricula of the rural midwest schools remain to be worked out.

I am sure all of us admire the good intentions and the technological ingenuity behind airborne ETV, and that we will feel somewhat relieved when the program gets off the ground, and more relieved when some of the complexities of the educational aspects of the program are effectively handled. In time they will be. Meanwhile it is probably a good thing that the prime movers of the project are unaware of the educational difficulties involved, or deliberately refuse to permit realization of these difficulties to interfere with the determination to overcome them, or consider the curriculum needs of rural schools in the midwest (and elsewhere) so great that alleviation of these needs is the only possible outcome of the project-in-operation.

The relationship between information and action is also highly complex. In the interest of getting on with this discussion, this problem will be dismissed with the comment that (1) too much information makes the choice of alternatives of action extremely difficult, and (2) strong habits do not yield easily to change, nor can information conveyed by any of the

media of communication successfully deny the realities of everyday living as experienced by those exposed to mediated information. Thus, in a political campaign, the slogan "You never had it better" is unlikely to appeal to the family man who is unemployed or, at best, employed only part-time. On the other hand, it appeals strongly to the materially prosperous. In the one case, it denies personal experience. In the other, it articulates personal experience.

In summary, then, the attribution of great power to the media of communication and the ignorance or avoidance of the complexity of communication leads to overoptimism concerning the results ordinarily obtained when new communications media are introduced into education.

One of the best brief discussions of what may be called the dynamics of communication with relation to the new media, the so-called "mass media", is to be found in Franklin Fearing's chapter in Part II of the 53rd yearbook of the NSSE published in 1954, i. e., six years ago. (2) It contains no answers to the problems of educational policy-makers, but it does summarize a number of research studies on the social impact of the mass media, and it sets forth various conclusions relevant to the effective use of these media in education. This chapter is must reading for all of us.

2. Ambivalence of Gadgetry

In the area of newer media in education there is a peculiar ambivalence toward gadgetry. Underlying the exaggerated expectations of results obtainable by the introduction and use of the newer media in education is a sort of naive belief in the magic of the gadget. In general, Americans tend to overstress the importance of hardware and to misunderstand the

complete dependence of hardware on the competence of human design and human use.

At the same time, there is fear that the gadget will radically change the role of the human being in controlling his environment and will, to some extent, actually displace him. Particularly, there is fear that control of the curriculum will be located at a remote source, that machines will take over a considerable proportion of basic instruction now handled directly by the classroom teacher or under his direct control and guidance.

Then, too, the introduction of television and of programmed self-instruction devices into education necessitates skills and techniques somewhat rare among the garden variety of classroom teachers. This increases the threat of gadgetry, or, more properly, of technology.

Closed-circuit ETV experimentation at Pennsylvania State University indicates that the normal complement of teachers required for instruction under conventional methods is reducible when instruction originates at a single source with outlets in several classrooms. (3) This, of course, is one of the several advantages asserted for television in education by A. J. Stoddard, in his widely circulated Schools for Tomorrow. (4) However, the specter of a proportionately decreasing market for the instructional labor force is not a comforting one for teachers, even though this market is expected to expand in response to predicted increases in student enrollment.

The ambivalence of faith and fear in technological devices, in what is here called gadgetry, hampers sound judgment in the acceptance, rejection, adaptation, or imaginative experimentation in the uses of newer media in education.)

3. Masking Categories

By this is meant the categories used to classify the newer media of communication. Quite generally, and for understandable reasons, these categories apply to a single aspect of a communication system. Thus, we categorize or classify newer media as motion pictures, i. e., according to what is reflected from a screen; as radio, i. e., according to the radio waves involved in transmission of sound signals; as television, i. e., according to the sensation of something transmitted over space; and as teaching machines, i. e., according to machinery for teaching.

In practice, we face no difficulty in distinguishing between these categories or in understanding the gross functions they perform. However, these categories actually serve to obscure certain factors which are of the utmost importance in the educational effectiveness of any medium of communication. One of these factors is actually a complex of factors which may be designated as stimulus characteristics, or presentational characteristics, or content characteristics. Another major factor is that of audience characteristics; this also is a complex of characteristics.

There has been considerable research on audience characteristics, but not nearly enough on presentational characteristics. Part of the complexity of the problem of assessing the contribution and effectiveness of the newer media in education can be grasped when one realizes that many interesting factors are present in any instructional program involving any medium of communication.

In effect, then, when we discuss the newer educational media in the accustomed categorization of motion pictures, television, teaching machines, etc., we obscure the very factors which operate to increase or decrease

their effect. Then we reduce the problem of decision making to that of acceptance or rejection of various physical devices in the curriculum.

Actually, this decision is of major importance. Normally it involves outlay of additional funds. Language laboratories, for example, require considerable space and expense.

It is doubtful that sound judgment will prevail in policy-making on the introduction and use of the newer media of communication unless results presently obtainable from use of these media are reasonably well known, unless ways of maximizing these results are considered, and unless some kind of a program for use of these communication systems is initiated.

If my understanding is correct, this conference is intended to provide information which will broaden the capacity for judgment of administrators and teachers in colleges for teacher education in devising policies toward the use of new media.

Balm in Galaad

At this point, I have the feeling that the net effect of my words is an impression of the Great Seriousness of policy-making regarding the newer media in education, of Disappointing Results obtained so far from research on these media, of the Complexity of Factors involved in obtaining satisfactory results with these media, and of Homework that must be done by policy-makers if they are to exercise Sound Judgment regarding the newer media.

I also have a suspicion that, in asserting these varities, I have made the whole subject appear to be unduely formidable, somewhat beyond the grasp of ordinary mortals, and one to be approached with great caution and with greater realization of the weakness than of the strength of the

human animal.

The first impression is intentional; the latter impression is precisely what is not intended. It is clear that the newer media are with us in education, and that we have no alternative but to face squarely the problems thereby raised.

IV: TRENDS IN MEDIA RESEARCH

At this point, or long before, it may reasonably be wondered when the subject of this paper would be dealt with, if at all. (The subject is research in newer media in education.) But, to discuss research out of context of its function in policy-making, out of context of the major changes occurring in American education, and out of context of conceptual difficulties and errors associated with the introduction of newer media, would be to side-step the obligation to help policy-makers in dealing with this problem area.

The history of research in newer media goes back to approximately 1920. We have thus had about forty years of such research. A look back over the research activities of this period provides certain insights into basic concepts of the functions of these media in education.

Early research on slides and motion pictures was lesson-centered. The problem investigated was how well these media teach a lesson. Each lesson taught was brief and discrete, a concept we still find operating in some of the current uses or abuses of motion pictures, television, and radio in education.

Later in the 1920's the research problem shifted from the discrete lesson to the increment in educational results associated with the addition of a series of visual aids, specifically motion pictures, to the existing curriculum. Nothing was dropped, while something was added.

The concept of the systematic use of visual aids as a curriculum additive was fundamental to this period of research. Results obtained were compared with those results obtained without the addition of visual aids.

Notice that this involves no systematic substitution of visual aids for live teachers, textbooks, or for anything else conventionally utilized in classroom teaching. The new pictorial media are regarded as a supplement, rather than a substitute.

The introduction of sound motion pictures and film strips during the 1930's gave rise to research studies of the comparative values of silent motion pictures, sound motion pictures, and film strips, just as the introduction of color film stimulated a series of studies of the comparative value of color and black and white films. These inter-media comparisons involved no major change in the concept of the role of the media in the curriculum.

The first major change in this concept ^{appeared} during World War II. Millions of servicemen had to be indoctrinated in the grim purpose of a war against ruthless opponents, and in the somewhat terrifying realization of kill-or-be-killed. Furthermore, they had to be trained in the special skills of modern warfare. This training had to be effective and it had to be done quickly.

These imperatives, plus the advanced development of technical, organizational, and dramatic skills in motion picture production, gave rise to the concept of motion pictures as a primary instrument of instruction, rather than simply as a supplementary one.

This concept was not entirely new. It had existed twenty years previously. It was basic to the enthusiastic development of the documentary film movement in England and its more halting development in this country. The educational significance of the war-time concept of motion pictures as a primary instrument lay in the fact that they were to be used in a formally organized program of education—or, for those who are sensitive on the point, a formally organized program of indoctrination and training.

Research then turned to the systematic study of ways of increasing the educational effectiveness of the newer media, either in the production stage or the use stage. Such items as the camera angle, the rate of presentation, the repetition attention-getting and attention-directing devices, overt audience participation, repeated showings, etc., were researched intensively.

Underlying these research problems was the concept of controlled learning, implying control of both stimulus and response. The concept was clearly evident at the time, if not fully articulated and somewhat vague.

Thus, in these two concepts—one, (the newer media as primary instruments of instruction, and, two, the control of learning by remote control of stimulus and response—lie the seeds or the sprouts of the major developments now evident in educational television and in programmed self-teaching (teaching machines).

In forty years; this concept of newer media in education has grown from one of a device for a lesson presentation to one of a complete system of remotely controlled instruction covering an entire course. Within this conceptual span, one has a choice of alternatives and combinations of media in teacher education and means for preparing teachers to deal effectively with these media in the schools of tomorrow, today.

V: BORROWED CONCEPTS: THEIR IMPORTANCE

The concepts underlying the research activities in new media in education have been broadened in various papers and discussions at recent conferences dealing with various aspects of newer media in education. During the past two or so years, I have participated in at least a dozen such conferences or meetings.

The concepts presented at these sessions that seem to be most useful in dealing broadly and comprehensively with the newer media in education have their origins in disciplines or cross-disciplines which, for the most part, did not exist thirty years ago. The significant thing about the discussion of these concepts is that it was done by professional educationists, psychologists, or sociologists, and that, basically, these concepts originated outside each of these fields.

Let me illustrate this phenomenon of prompting or borrowing in the programming concept of programmed self-instructional devices. The prototype of the logic of programming basic to today's "teaching machines" was substantially advanced in the course of the development of the world's first high-speed, electronic, digital computer, the ENIAC, at the University

of Pennsylvania's Moore School of Electric Engineering. Computer programming consists of the complete and specific detailing of a great number of small-step, serial operations to be performed by the computer. A competent computer program also includes detailed specification of machine operation for all contingencies.

Programmed self-instruction incorporates this logic of detailed specification of a large number of small-step, serial operations. The difference is that self-instructional operations are generally thought processes and these are performed by the human learner, not by a machine. In fact, a machine is not necessary. A textbook can also incorporate a program of self-instruction. The term, teaching machines, is grossly misleading, both as to necessary equipment, and as to the process involved in programmed self-instruction.

Programmed self-instructional devices have been developed for use in education largely by psychologists, and psychologists, in turn, have been prompted by the concept of programming developed by computer scientists. Thus, inter-disciplinary borrowing has become not only respectable but necessary, and the advice of Polonius to his son has been cast into discard in the New House of Intellect.

This interdependence among disciplines is not an isolated event, unique to programming. In his formidable little book on Thinking (5), Sir Frederick Bartlett includes the following two observations on "important determining influences" on the success of the individual experimenter:

(a) While the particular kind of subject-matter which he takes up will depend mainly on the direction of his interests and opportunities, he is unlikely to achieve very much unless his exploration takes him into potentially overlapping fields of scientific exploration.

(b) It is likely that the most critical steps that he takes will be due to prompting coming from other people, or from other sources, outside himself and his planned beginnings of experiment.

Sir Frederick's observations may be generalized to the kind of experimentation that is now going on in schools and colleges throughout the country and which must, according to the report of the President's Commission on National Goals, be expanded all the way from first grade through college.

The newly realized problems of American education are not likely to be solved by educators without prompts and other kinds of help from outside the profession. Such prompts have already been recognized and accepted by "experts" in the field of newer media. However, as Riley (6) points out, the values and opinions of "experts" do not correlate highly with those of practitioners, even after a dozen years, and, in all probability, for a much longer period.

Of the many "borrowed ideas" advanced in conferences over the past few years, three seem to be particularly pertinent and urgent: technology and the instructional process, the systems concept, and innovation in social institutions, such as in schools and colleges.

Technology in Instruction

The concept of technology in instruction, inclusive of all the newer media in education, has been advanced most cogently and convincingly by Finn at various conferences and in a series of well-written papers, the last of which is most pertinent. (7)

By greatly reducing Finn's informed discussion, oversimplifying

it, and doing as little damage as possible in the process, we can arrive at a concept of technology as an integrated complex of ideas, organization, management, and machines.

As technology advances, much of the craft, clerical, manual, and factory type work previously performed by men is taken over by machines. As this happens, and as a necessary condition of its occurrence, men acquire new skills, so far believed to be unique to human beings, and they devote more of their time and effort to planning, designing, managing, and monitoring operations performed by both men and machines. Thus, man's role is changed and his abilities are greatly expanded and extended by technology. Meanwhile, severe dislocation is likely to occur. Fear of displacement and resistance to changes in occupation and employment arouse bitter opposition to the introduction of machines.

Among other things, Finn emphasizes what seem to be three central facts about technology in instruction: (a) educators have almost totally ignored the broad concept of technology; as a result, education is in a primitive stage of technology, far behind industry; (b) the introduction of machines into instruction has been hesitant and constitutes only a piece-meal approach to the four-fold complex of ideas, organization, management, and machines; and (c) the "good old days" are gone forever, and while the days ahead will be different and may be difficult, they will be better and not as difficult as might be supposed.

An illustration of Finn's thesis may help. Most professional educators agree that the function of the teacher is to organize the environment for learning and to guide the learning activities of students in

their attainment of educational objectives. The concept of technology, applied to instruction, involves exactly this function of the teacher, but re-aligns the means and the responsibilities, and requires organization and management of instruction consistent with this re-alignment. While evidences of this application of technology are at hand, there is little evidence that the full implications of technology in instruction are well understood.

The Systems Concept

The systems concept was discussed by Carpenter (8), Hoban (9), and Riley (6) at the Stanford conference on newer media in education in November, 1959. It is difficult to summarize these discussions within the scope of this paper without risking oversimplification with each of them. Underlying each discussion, however, is the concept of a system as an arrangement of components so that compatability and purposeful performance are achieved by organization and adjustment between and among the components.

4 when 2
One of the best examples of application of the systems concept to newer media in education is to be found in the report of closed-circuit television at Pennsylvania State College. (3) The physical equipment, technical personnel required to operate and maintain this equipment, the methods of selecting TV instructors, acceptance of television instruction by faculty and students, unit costs of instruction by television, educational results obtained, and the effects of television instruction on the number of required faculty members and released time of faculty members--all these were taken into account in the research, and presumably all will

be considered in policy and operating decisions on future use of television in instruction at Pennsylvania State University.

The systems concept fits hand-in-glove with the concept of technology of instruction. It enables us to examine more fully what is involved in the introduction and use of newer media in education and to plan more thoroughly, more comprehensively, and with greater foresight for the overall instructional program of which the media are only one element. This means planning for much more than the classroom of tomorrow, as important as classroom planning is.

Innovation in Instruction

Above all, innovation involves the human reception of and response to a new idea carried or about to be carried into action. The introduction and implementation of a new idea forces us to reassess the ideas we presently cling to, the objectives that can be attained by existing and proposed means, and our role in and degree of control of our personal and social worlds.

The difficulty with the growth of technology, and with systems planning, is that both tend to disturb the equilibrium of the social system including the dependent, independent, and interdependent relationships among people. We are all for planning when it works to our advantage not our disadvantage, and we are all for technology when it eases our burdens and raises our living standards but not when it threatens to dislocate us, or reduce our prestige, or lower our status.

The introduction of any new medium into instruction is always accom-

panied by change in something other than the medium of instruction. Slides, filmstrips, and motion pictures require projectors, screens, and greater control of illumination and ventilation, and these, in turn, require additional skills on the part of the teacher as well as additional services of supply and maintenance of the additional equipment and the photographic materials. The newer media also require the development of new ideas and procedural competencies for their effective employment in instruction.

In the pre-war concepts of the functions of these media in teaching, the classroom teacher retained the role of master teacher in the sense that he or she controlled what, when, and how the subject content was selected, what medium was to be used, and the techniques of teaching with these media.

A new professional group of audio-visual specialists developed in order to promote the use of these new media in classroom teaching, to supply and maintain films and projectors, and, in many cases, to turn photography into a public relations asset for educational executives.

The innovation was slow, remained largely optional with classroom teachers, and never quite outgrew its cumbersomeness. No one was greatly disturbed by it. New jobs were created and the old ones remained largely unchanged in quantity or character. The same could be said about radio in education, about sound recordings and tapes, about overhead projectors and the transparent plastic on which teachers could draw or write while facing the class.

Television and "teaching machines" are quite a different matter.

With the latter, there is no face-to-face relationship between teacher and student, but a dialogue between the "machine" and the student. The programmer is the teacher, and the instruction is completely controlled by the programmer in that he controls the information presented the student, the student's response to this information, and the student's next step. (10,11)

The fact that, under generally agreed-on conditions of program preparation and adroit manipulation of cues, repetition, progression, and reinforcements, programmed-self instruction has been observed to result in greater and more enthusiastic learning in less time-- this fact makes this innovation particularly significant in terms of its efficiency, and potentially threatening to the status quo in its transfer of control over learning from the classroom teacher to a remote and often unknown programmer. The trend in experimentation with television in education is also in the direction of transfer of control over learning from the classroom teacher to the studio teacher.

In the human terms of the teaching profession, both these innovations deprive the classroom teacher of previous status as a master teacher, i.e., as master of the face-to-face teaching situation. The role of the classroom teacher is changed and a significant re-alignment of responsibility for and control over the instructional process takes place. In a sense, the programmer and studio teacher become the master teachers, and the classroom teacher must develop new ideas on and procedures of management.

An excellent discussion of some of the problems of innovation in education and some of the sources of its accompanying social disturbance

is to be found in Riley's (6) brief but provocative paper presented at the Stanford conference.

When we introduce newer media in education we introduce it at the local, operating level of the educational system. This involves the introduction of new and different systems of instruction. The installation of the technical equipment required is likely to be the least difficult and troublesome part of this process of innovation, even though it involves additional expense and requires the addition of technical personnel to operate and maintain this technical equipment.

VI: CONCLUSIONS FROM RESEARCH ON NEWER MEDIA

Drawing up a set of conclusions based on research of the past forty years on newer media in instruction is always difficult. The difficulty arises from the large number of research studies, the variety of problems investigated in these studies, and the range of media on which the research has been done. For practical purposes, however, it is possible to set forth half a dozen or so general conclusions on which there is likely to be a consensus of agreement.

There is little firm evidence in the research literature that any medium of instruction is intrinsically or invariably superior to any other medium in instruction. The quest for inter-media superiority is a lost labor of love. One reason for this lies in the fact that the media are not one-dimensional. Books include pictures. Motion pictures and television include pictures, language, music, and ambient noises. Filmstrips include pictures and print.

Pictures do not have the facility for expression of abstract thought that language has. Language, in turn, is a transparent medium. We put meanings into the printed word as much, if not more, than we get meanings out of it. Also, as McLuhan points out (12), print is linear and pictures are mosaic in composition. This difference is probably more psychologically significant than we have hitherto supposed.

As indicated earlier in this paper, the process of communication is complex. It may be added that the process of learning is even more so. Progress made by psychologists in the learning field is clearly evident in the development of programming techniques for self-instruction.

It seems evident that whatever virtues the Skinner-type teaching machines have are not likely to arise simply from the verbal character of their programmed content, but from the elaborate psychological mechanisms employed and invoked in programming the verbal content for machines which require physical as well as mental response from the student. The masking categories previously discussed obscure the important variables involved in new media used in instruction.

There is reason to believe that media are complementary, not competitive, and that a combination of media in the instructional process is superior to any one alone. Research on media behavior of adults indicates that patrons of one medium tend to be patrons of others as well, and that non-patrons of some of the media tend to be non-patrons across the board.

Inter-media effects tend to be cumulative. The combination of motion pictures and reading materials, for example, has been shown to be instruc-

tionally superior to reading materials without motion pictures.

It is difficult to imagine that the classroom of the future will contain only one of the several newer media. Intuitively we seem to recognize that a single method or a single medium of instruction will not suffice, even if only because it will become unbearably monotonous. Variety among instructional media seems to be more efficient than a monopoly of one.

The research literature includes some data which rather convincingly suggest that the elaborate and time-consuming preparations involved in the production of instructional motion pictures, television, and programmed self-instruction contributes substantially to their effectiveness. Reports from television teachers emphasize the difference in time, effort, and difficulty of teaching over television vs. ordinary classroom teaching. Programs for self-instruction undergo continuing testing and revision in the process of their development. No program is considered adequate until it has been demonstrated to be effective, i.e., relatively error-proof, and this adequacy is presently achieved by a try-test-revise routine that seems to be as effective as it is laborious and time-consuming.

Prolonged time and intense effort, i.e., the middle-class virtues of long hours and hard work, are not sufficient in themselves to produce maximum instructional effectiveness of newer media in instruction. In fact, they may detract from this effect if they are expended in doing things badly with the best but not the best-informed intentions. The skillful and deliberate use of well known principles of learning and teaching, either built into the mediated instruction or incorporated in the classroom use of the instructional media, increase their educational

effectiveness. Of all things abundantly demonstrated in a number of research studies on newer media in instruction, this is the one most abundantly demonstrated.

We are beginning to learn in media research that high motivation is a critical element in learning from the newer media. Published and unpublished research -- mostly unpublished research -- on early-morning TV courses for college credit, broadcast over commercial stations or networks, indicates that early-rising credit-seeking viewers are highly motivated. In general, the test performances of these students is equal to and in many cases better than that of on-campus undergraduate students.

However, some of the newer media and their uses in instruction, run into opposition from both faculty and students. The initial antagonism of students toward complete TV instruction tends to decrease over time, and the antagonism among faculty members is most often and most vehemently expressed by teachers who have not participated at all in the use of the new medium or whose participation was approached with strong mental reservations, or, more bluntly, anti-medium prejudice.

VII. THE CASE IN BRIEF

In an early section of this paper, the problem of this conference was formulated in terms of the function of research in helping to extend and deepen the capacity of judgment of administrators and teachers in colleges for teacher education in deriving policies governing the installation and use of newer media in education.

Blocks to judgment were reviewed, such as overexpectancy and over-

optimism about the power of new media as a function of the media, the ambivalent attitude toward gadgetry in which we have great faith and great fear at the same time, and the way we categorize the instructional media in such a way as to mask the important variables and oversimplify our thinking on communication.

A review of concepts of the media underlying the newer media studies indicated that there has been a gradual shift in the concept of the function of the newer media from that of lesson-teaching to that of primary instructional media, extending to a high degree of control of learning by stimulus-response control of learning behavior.

Three additional concepts, advanced at conferences on new media in instruction, were then examined; technology, systems, and innovation in instruction. Throughout the discussion of these concepts, attempt was made to indicate that much more is involved in the significant increase of educational efficiency than the installation and use of the media themselves.

Research was then summarized in such a way as to suggest that the instructional efficiency of the newer media derives not so much from the media themselves, as from the effective use of psychological principles of teaching and learning incorporated into the media. The media serve to distribute built-in instructional excellence more widely and without variation from place to place and from time to time.

The flow of discussion throughout the paper was directed away from consideration of the newer media in isolation toward consideration of the media in the context of technological advances, systems concepts, and

problems of innovation in instruction.

Thus, we conclude with a partial reformulation of the problem to include the education of teachers in the direction of (a) changes in the role, the type of control, and the methodology of the teacher that the newer media are thrusting upon American education, and (b) the acceptance of newer ideas, newer organizational patterns, and newer ways of managing the educational process, i.e., in terms of technology of instruction of which newer media are an element.

This is a tall order. But men grow tall these days in the United States. It is a long-view of the problem, but the problem will be with us for a long time.

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